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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/734,922	12/11/2003	Mark C. Morris	H0005667-1170	2263

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EXAMINER	
EDGAR, RICHARD A	

ART UNIT	PAPER NUMBER
3745	

DATE MAILED: 05/25/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/734,922	MORRIS ET AL.	
	Examiner	Art Unit	
	Richard Edgar	3745	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *11 December 2003 under 37 C.F.R.§1.53(b)*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-32* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-32* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *11 December 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *12/11/2003*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

Specification

The lengthy specification has not been checked to the extent necessary to determine the presence of all possible minor errors. Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 16, 17, 19 and 20 are rejected under 35 U.S.C. 102(b) as being anticipated by United States Patent no. 5,964,575 (Marey hereinafter).

Marey discloses an apparatus for a turbine engine comprising an axisymmetric plenum balloon 5, 7 having an impingement cooling array 12 therethrough; a plurality of flow metering openings (see curved arrow in Fig. 2 passing through metering opening) in fluid communication with the axisymmetric plenum balloon; and a plurality of inlet openings 9 in flow communication with the flow metering openings.

The impingement cooling array 12, 12' comprises a plurality of forward hanger cooling impingement openings, a plurality of aft hanger cooling impingement openings, and a plurality of shroud cooling impingement openings (see Figures).

The axisymmetric plenum balloon comprises a sheet metal form (see Fig. 2).

The turbine engine has a plurality of shroud segments 3, and the axisymmetric plenum balloon 5, 7 follows a contour of a radially outward side of the shroud segments (see Figs.).

Claims 16, 17, 19, 20 and 21 are rejected under 35 U.S.C. 102(b) as being anticipated by United States Patent No. 5,273,396 (Albrecht et al. hereinafter).

Albrecht et al. show an apparatus for a turbine engine comprising: an axisymmetric plenum balloon 94 having an impingement cooling array 98 therethrough; a plurality of flow metering openings 92 in fluid communication with the axisymmetric plenum balloon; and a plurality of inlet openings 88 in flow communication with the flow metering openings.

The impingement cooling array comprises a plurality of forward hanger cooling impingement openings, a plurality of aft hanger cooling impingement openings, and a plurality of shroud cooling impingement openings (see Fig. 3).

The axisymmetric plenum balloon comprises a sheet metal form (see Fig. 3 and 5).

The turbine engine has a plurality of shroud segments 72, and the axisymmetric plenum balloon follows a contour of a radially outward side of the shroud segments (see Fig. 3).

The inlet openings 88 are radially outward from the axisymmetric plenum balloon 94.

Claim 27 is rejected under 35 U.S.C. 102(e) as being anticipated by United States Patent Application No. 2003/0185674 (Alford et al. hereinafter).

Alford et al. disclose a method wherein ceramic shroud segments 32 are provided circumferentially about a longitudinal centerline axis, a forward hanger 48, 53 radially outward from and forward of the ceramic shroud segments, an aft hanger 48, 53 radially outward from and aft of the ceramic shroud segments, and a plenum assembly 62, 64 between and in contact with the forward hanger and the aft hanger, wherein cooling air is supplied to the plenum such that the air impinges on the shroud segments, the forward hanger and the aft hanger (see paragraph 0027).

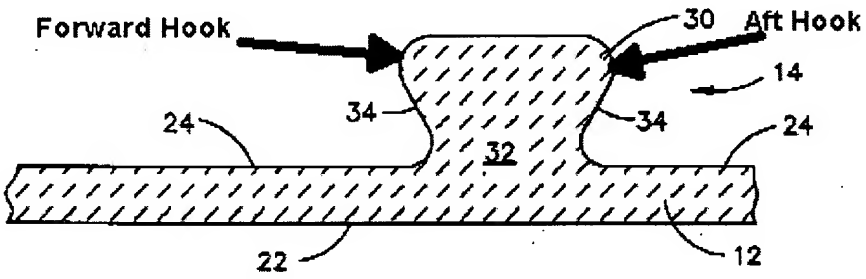
Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

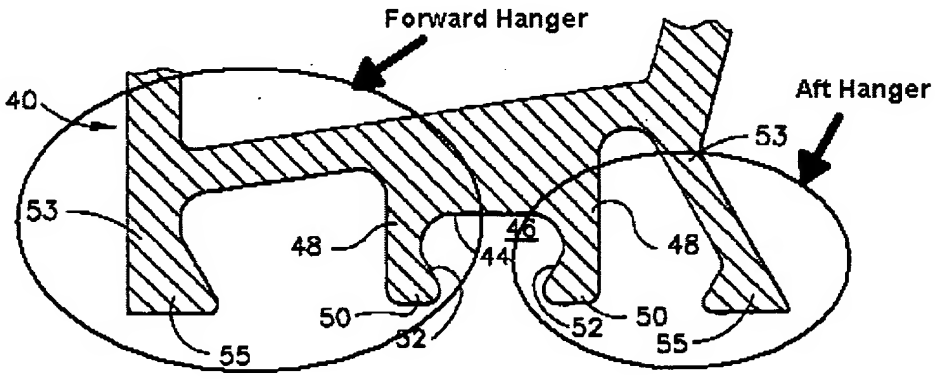
Claims 1-3 are rejected under 35 U.S.C. 103(a) as being unpatentable over United States Patent Application No. 2003/0185674 in view of United States Patent Application No. 2004/0120808, and further in view of United States Patent No. 6,575,697 (Arilla et al. hereinafter).

The Alford et al. 2003/0185674 patent application shows ceramic shroud segments 12 having a forward hook and an aft hook (see annotated Fig. 2 below).



Annotated 2003/0185674 Figure 2

The reference also shows in Fig. 3 a forward hanger and an aft hanger which engages the forward hook and aft hook, respectively.



Annotated 2003/0185674 Figure 3

Additionally, as seen in Fig. 4, rope seals 58 are used between the shroud segments and the hangers such that the rope seals are radially inward from the hangers. Further, when assembled, a plenum assembly comprising cavities 62 and 64 is positioned between and in contact with the at least one forward hanger and the at least one aft hanger. Also, the forward hanger comprises a rail 53 having an o-ring groove 60 positioned circumferentially on a radially inward side. And the aft hanger comprises an aft hanger rail 53 having an angled surface 60.

The 2003/0185674 patent application does not show spacer seals arranged in spacer channels, nor the aft hanger rail angled surface being on the forward edge of the radially inward side.

The Alford et al. 2004/0120808 patent application teaches a turbine shroud assembly comprising: a plurality of ceramic shroud segments 24 assembled circumferentially about a longitudinal engine centerline axis; and a plurality of ceramic spacer seals 44 (see paragraph 0016, lines 6-9) positioned in contact with said ceramic shroud segments, such that each one of said ceramic spacer seal is in contact with the radially outward side of two adjacent ceramic shroud segments (see Fig. 2) for the purpose of sealing adjacent segments.

Since the 2003/0185674 patent application shows adjacent shroud segments and the 2004/0120808 patent application shows how to seal adjacent shroud segments, it would have been obvious at the time the invention was made to a person having ordinary skill in the art to seal the adjacent shroud segments of the 2003/0185674

patent application with the seals taught in the 2004/0120808 patent application for the purpose of sealing adjacent shroud segments.

Arilla et al. show in Fig. 2 an aft hanger 38 having an angled surface on a forward edge of the radially inward side, wherein a seal 55 is positioned for the purpose of reducing the leakage of shroud cooling air.

Since the 2004/0120808 and 2003/0185674 patent application are shroud segments for a turbine engine and the Arilla et al. reference teaches an aft seal for shroud segments of a turbine, it would have been obvious at the time the invention was made to a person having ordinary skill in the art to modify the aft shroud hanger seal groove of 2003/0185674 patent application to be an angled surface on a forward edge of the radially inward side for the purpose of reducing the leakage of shroud cooling air.

Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over United State Patent Application No. 2003/0185674 in view of United States Patent Application No. 2004/0120808, and further in view of United States Patent No. 6,575,697 (Arilla et al. hereinafter) as applied to claim 1 above, and further in view of United States Patent No. 5,188,506 (Creevy et al. hereinafter).

The patent applications 2003/0185674 and 2004/0120808 in view of Arilla et al. show a rope seal.

None of the references disclose the composition of the rope being a hybrid ceramic.

Creevy et al. show a seal 54 for use between a turbine shroud hanger 12 and a turbine shroud 16 wherein the seal is a hybrid rope made with Inconel and silica (see col. 4, lines 19-27) for the purpose of withstanding turbine engine temperatures.

Since the patent applications 2003/0185674 and 2004/0120808 in view of Arilla et al. show a rope seal and Creevy et al. teach that the seal between a turbine shroud and turbine shroud support should be made from Inconel and silica for the purpose of withstanding the hot turbine engine operating temperatures, it would have been obvious at the time the invention was made to a person having ordinary skill in the art to make the patent applications 2003/0185674 and 2004/0120808 in view of Arilla et al. rope seal from Inconel and silica, as taught by Creevy et al. for the purpose of withstanding turbine engine operating temperatures.

Claims 5 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over United States Patent Application No. 2003/0185674 in view of United States Patent Application No. 2004/0120808, and further in view of United States Patent No. 6,575,697 (Arilla et al. hereinafter) as applied to claim 1 above, and further in view of United States Patent No. 6,197,424 (Morrison et al.).

The patent applications 2003/0185674 and 2004/0120808 in view of Arilla et al. show ceramic shrouds and seals made from a CMC material. However, Silicon nitride (SiN) is not specifically recited in any of the references.

Morrison et al. teach that CMC materials, including silicon nitride are used in turbine engines for the purpose of withstanding the operating temperatures of the turbine (see paragraph 25).

Since the patent applications 2003/0185674 and 2004/0120808 in view of Arilla et al. show ceramic shrouds and seals made from a CMC material and Morrison et al. teach that silicon nitride, also a CMC material, should be used in turbine components, it would have been obvious at the time the invention was made to a person having ordinary skill in the art to use a silicon nitride material for the shroud and seals as taught by Morrison et al. for the purpose of withstanding the operating temperatures of the turbine.

Claims 6 and 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over United States Patent Application No. 2003/0185674 in view of United States Patent Application No. 2004/0120808, and further in view of United States Patent No. 6,575,697 (Arilla et al. hereinafter) as applied to claim 1 above, and further in view of United States Patent No. 3,986,720 (Knudsen et al.).

The patent applications 2003/0185674 and 2004/0120808 in view of Arilla et al. show hangers made from a metal, but not a nickel-based alloy.

Knudsen et al. teach that nickel-based alloys are used in turbine applications with high operating temperatures for the purpose of ensuring safe operation (see col. 2, line 31-39).

Since the patent applications 2003/0185674 and 2004/0120808 in view of Arilla et al. show metal hangers and Knudsen et al. teach nickel-based alloys as the material for high temperatures, it would have been obvious at the time the invention was made to a person having ordinary skill in the art to modify the metal hanger of he patent applications 2003/0185674 and 2004/0120808 in view of Arilla et al. to be a nickel-based alloy as taught by Knudsen et al. for the purpose of ensuring safe operation.

Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over United States Patent Application No. 2003/0185674 in view of United States Patent Application No. 2004/0120808, and further in view of United States Patent No. 6,575,697 (Arilla et al. hereinafter) as applied to claim 1 above, and further in view of United States Patent No. 5,593,276 (Proctor et al. hereinafter).

The patent applications 2003/0185674 and 2004/0120808 in view of Arilla et al. show a forward hanger, but no slots extend radially.

Proctor et al. show a turbine shroud forward hanger having slots 50 extending radially for the purpose of reducing ring hoop stress during thermal expansion.

Since the patent applications 2003/0185674 and 2004/0120808 in view of Arilla et al. have hangers which experience hoop stress during transient thermal expansion, and Proctor et al. teach that slots reduce the hoop stress, it would have been obvious at the time the invention was made to a person having ordinary skill in the art to modify the forward hanger of the patent applications 2003/0185674 and 2004/0120808 in view of

Arilla et al. to have radial slots, as taught by Proctor et al. for the purpose of reducing ring hoop stress during thermal expansion.

Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over United States Patent Application No. 2003/0185674 in view of United States Patent Application No. 2004/0120808, and further in view of United States Patent No. 6,575,697 (Arilla et al. hereinafter) as applied to claim 1 above, and further in view of United States Patent No. 6,197,424 (Morrison et al.).

The patent applications 2003/0185674 and 2004/0120808 in view of Arilla et al. show ceramic shrouds and seals made from a CMC material. However, a TBC on the shrouds is not specifically recited in any of the references.

Morrison et al. teach that CMC materials, including silicon nitride are used in turbine engines for the purpose of withstanding the operating temperatures of the turbine (see paragraph 25). Additionally, a TBC 10 is applied to the inner surface of the shrouds 42 (see Fig. 6) for the purpose of providing insulation and abradability (see col. 10, lines 55-62).

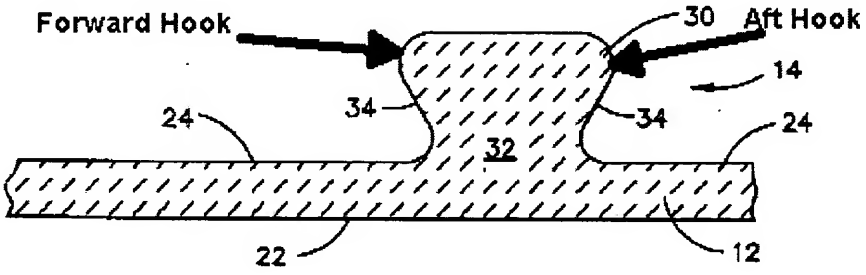
Since the patent applications 2003/0185674 and 2004/0120808 in view of Arilla et al. show ceramic shrouds and seals made from a CMC material and Morrison et al. teach that silicon nitride, also a CMC material, should be used in turbine components along with a TBC, it would have been obvious at the time the invention was made to a person having ordinary skill in the art to use a TBC on the shrouds as taught by Morrison et al. for the purpose of providing insulation and abradability.

Claims 11-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over United States Patent Application No. 2004/0120808 in view of United States Patent Application No. 2003/0185674.

The Alford et al. 2004/0120808 patent application teaches a turbine shroud assembly comprising: a plurality of ceramic shroud segments 24 assembled circumferentially about a longitudinal engine centerline axis; and a plurality of ceramic spacer seals 44 (see paragraph 0016, lines 6-9) positioned in contact with said ceramic shroud segments, such that each one of said ceramic spacer seal is in contact with the radially outward side of two adjacent ceramic shroud segments (see Fig. 2).

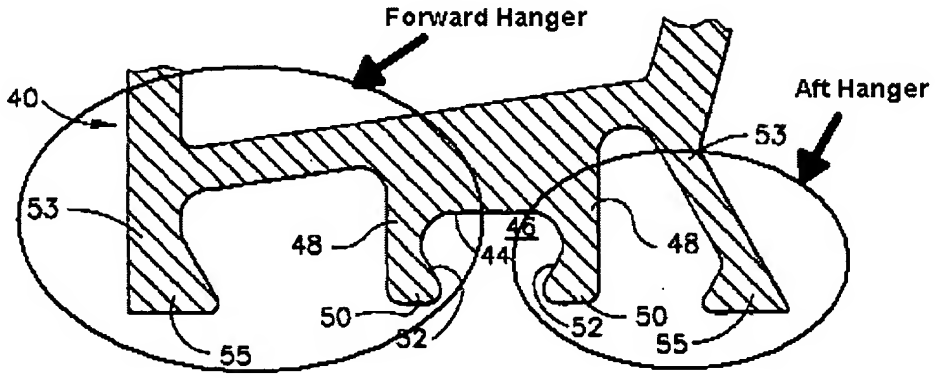
The Alford et al. 2004/0120808 patent application does not show each shroud segment having a forward hook and an aft hook.

The Alford et al. 2003/0185674 patent application shows ceramic shroud segments 12 having a forward hook and an aft hook (see annotated Fig. 2 below) for the purpose of positioning the ceramic shroud segments to the turbine casing.



Annotated 2003/0185674 Figure 2

The reference also shows in Fig. 3 a forward hanger and an aft hanger which engages the forward hook and aft hook, respectively.



Annotated 2003/0185674 Figure 3

Additionally, as seen in Fig. 4, rope seals 58 are used between the shroud segments and the hangers such that the rope seals are radially inward from the hangers.

Since the 2004/0120808 Alford et al. patent application shows ceramic turbine shroud segments, and the 2003/0185674 Alford et al. patent application teaches the mounting arrangement of ceramic turbine shroud segments, it would have been obvious at the time the invention was made to a person having ordinary skill in the art to mount the ceramic segments of the 2004/0120808 patent application by the arrangement taught in the 2003/0185674 patent application for the purpose of fixing the ceramic turbine shroud segments to the turbine casing.

Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over United States Patent Application No. 2003/0185674 in view of United States Patent Application 2004/0120808 in view of United States Patent No. 6,197,424 (Morrison et al.

hereinafter) in view of United States Patent No. 3,986,720 (Knudsen et al.) in view of United States Patent No. 6,575,697 (Arilla et al. hereinafter) in view of United States Patent No. 5,273,396 (Albrecht et al. hereinafter).

United States Patent Application No. 2003/0185674 shows a plurality of ceramic shroud segments assembled circumferentially about a longitudinal engine centerline axis, wherein each shroud segment has a forward hook and an aft hook; a forward hanger positioned radially outward from the shroud segments and having a rail with an o-ring groove on the radially inward side; a rope seal poisoned in the o-ring groove; an aft hanger having a rail and an aft rope seal; and a plenum assembly.

The patent application 2003/0185674 does not show the ceramic segments being a silicon nitride, a plurality of silicon nitride spacer seals spaced in channels, the hangers being a nickel-based superalloy, the aft rail having a forward angled surface, and the plenum assembly having impingement, metering and inlet openings.

United States Patent Application 2004/0120808 however, shows ceramic spacer seals arranged in channels between adjacent shrouds for the purpose of sealing the segments.

Since the 2003/0185674 application shows circumferential segments and the 2004/0120808 application shows how to seal adjacent segments, it would have been obvious at the time the invention was made to a person having ordinary skill in the art to modify the circumferential joints of the 2003/0185674 application to have the joints taught in the 2004/0120808 application for the purpose of sealing the segments.

The patent applications 2003/0185674 and 2004/0120808 show ceramic shrouds and seals made from a CMC material. However, Silicon nitride (SiN) is not specifically recited in any of the references.

Morrison et al. teach that CMC materials, including silicon nitride are used in turbine engines for the purpose of withstanding the operating temperatures of the turbine (see paragraph 25).

Since the patent applications 2003/0185674 and 2004/0120808 show ceramic shrouds and seals made from a CMC material and Morrison et al. teach that silicon nitride, also a CMC material, should be used in turbine components, it would have been obvious at the time the invention was made to a person having ordinary skill in the art to use a silicon nitride material for the shroud and seals as taught by Morrison et al. for the purpose of withstanding the operating temperatures of the turbine.

The patent applications 2003/0185674 and 2004/0120808 in view of Morrison et al. show hangers made from a metal, but not a nickel-based alloy.

Knudsen et al. teach that nickel-based alloys are used in turbine applications with high operating temperatures for the purpose of ensuring safe operation (see col. 2, line 31-39).

Since the patent applications 2003/0185674 and 2004/0120808 in view of Morrison et al. show metal hangers and Knudsen et al. teach nickel-based alloys as the material for high temperatures, it would have been obvious at the time the invention was made to a person having ordinary skill in the art to modify the metal hanger of he patent

applications 2003/0185674 and 2004/0120808 in view of Morrison et al. to be a nickel-based alloy as taught by Knudsen et al. for the purpose of ensuring safe operation.

Arilla et al. show in Fig. 2 an aft hanger 38 having an angled surface on a forward edge of the radially inward side, wherein a seal 55 is positioned for the purpose of reducing the leakage of shroud cooling air.

Since the 2004/0120808 and 2003/0185674 patent application are shroud segments for a turbine engine and the Arilla et al. reference teaches an aft seal for shroud segments of a turbine, it would have been obvious at the time the invention was made to a person having ordinary skill in the art to modify the aft shroud hanger seal groove of 2003/0185674 patent application to be an angled surface on a forward edge of the radially inward side for the purpose of reducing the leakage of shroud cooling air.

Albrecht et al. show a shroud segment being cooled by a plenum balloon 94 having impingement openings 98 in communication with metering openings 92 and inlet openings 88 for the purpose of cooling the shroud.

Since patent application 2003/0185674 shows a shroud segment being cooled by a plenum 62, 64 and Albrecht et al. teach a plenum having impingement, metering and inlet openings, it would have been obvious at the time the invention was made to a person having ordinary skill in the art to use the plenum balloon configuration of Albrecht et al. as the plenum cooling teaching of the 2003/0185674 patent application for the purpose of directing cooling air to the shroud segments.

Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over United States Patent No. 5,964,575 (Marey hereinafter).

Marey shows an inlet and metering opening, as explained above with reference to claim 16, but does not specify the relative cross-sectional area ratio between the two openings.

At the time the invention was made, it would have been an obvious matter of design choice to a person of ordinary skill in the art to make the inlet openings at least three times the area of the metering openings of Marey because Applicant has not disclosed that the ratio of the cross-sectional areas provides an advantage, is used for a particular purpose, or solves a stated problem. One of ordinary skill in the art, furthermore, would have expected Marey's cooling arrangement, and applicant's invention, to perform equally well with either the area geometry taught by Marey or the claimed 3 times larger ratio because both areas would perform the same function of controlling the volume of air entering the plenum without causing backflow.

Therefore, it would have been prima facie obvious to modify Marey to obtain the invention as specified in claim 18 because such a modification would have been considered a mere design consideration which fails to patentably distinguish over the prior art of Marey.

Claim 22 is rejected under 35 U.S.C. 103(a) as being unpatentable over United States Patent No. 5,273,396 (Albrecht et al.) as applied to claim 16 above, and further in view of United States Patent No. 5,593,276 (Proctor et al. hereinafter).

The Albrecht et al. inlet openings are defined in a part that extends vertically, wherein there is not a vertical flange radially outward from and aft of the inlet openings.

Proctor et al. disclose a vertical flange 26b radially outward from and aft of an inlet opening 58 for the purpose of defining a flowpath of cooling air for aft parts of the shroud segment.

Since the Albrecht et al. shroud segment has an aft cavity and Proctor et al. show how to cool an aft cavity, it would have been obvious at the time the invention was made to a person having ordinary skill in the art to modify the component 66 to have the inlet opening 88 radially inward therefrom and forward thereto, as taught by Proctor et al. for the purpose of defining a flowpath of cooling air for aft parts of the shroud segment.

Claims 23, 24 and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over United States Patent Application Publication No. 2003/0185674 (Alford et al. hereinafter) in view of United States Patent No. 5,188,506 (Creevy et al. hereinafter).

Alford et al. disclose a rope seal apparatus 58 for use between a turbine shroud 12 and a turbine shroud hanger 40 comprising a rope 58 positioned between and in contact with the turbine shroud 12 and the turbine shroud hanger 40, such that the turbine shroud hanger 40 is radially outward from the rope 58 (see Fig. 4). The turbine hanger 40 comprises a forward hanger 53 having a circumferential o-ring groove 60 positioned on a radially inward side, and the rope 58 being in contact with the

circumferential o-ring groove 60. The turbine shroud 12 comprises a plurality of turbine shroud segments (see Abstract).

Alford et al. do not disclose the composition of the rope being a hybrid ceramic.

Creevy et al. show a seal 54 for use between a turbine shroud hanger 12 and a turbine shroud 16 wherein the seal is a hybrid rope made with Inconel and silica (see col. 4, lines 19-27) for the purpose of withstanding turbine engine temperatures.

Since Alford et al. teach a turbine shroud and turbine shroud support with a seal therein between and Creevy et al. teach that the seal between a turbine shroud and turbine shroud support should be made from Inconel and silica for the purpose of withstanding the hot turbine engine operating temperatures, it would have been obvious at the time the invention was made to a person having ordinary skill in the art to make the Alford et al. seal from Inconel and silica, as taught by Creevy et al. for the purpose of withstanding turbine engine operating temperatures.

Claim 25 is rejected under 35 U.S.C. 103(a) as being unpatentable over United States Patent Application Publication No. 2003/0185674 (Alford et al. hereinafter) in view of United States Patent No. 5,188,506 (Creevy et al. hereinafter) as applied to claim 23 above, and further in view of United States Patent No. 6,575,697 (Arilla et al. hereinafter).

Alford et al. in view of Creevy et al. teach a seal between a turbine shroud and a turbine shroud hanger. The aft portion of the hanger has a seal disposed therein (see Alford et al. Fig. 4.

The combination of references however, does not teach the aft hanger to have a circumferential angled surface positioned on a forward edge of the radially inward side, wherein the seal is positioned.

Arilla et al. show in Fig. 2 the aft hanger 38 having an angled surface on a forward edge of the radially inward side, wherein a seal 55 is positioned for the purpose of reducing the leakage of shroud cooling air.

Since the Alford et al. in view of Creevy et al. combination of references teaches a turbine shroud and turbine shroud hanger with a seal therebetween, both at upstream and downstream portions, and Arilla et al. teach that the aft portion of the turbine shroud hanger should have an angled surface on a forward edge of the radially inward side, wherein a seal is positioned for the purpose of reducing the leakage of shroud cooling air, it would have been obvious at the time the invention was made to a person having ordinary skill in the art to modify the aft shroud hanger seal groove of Alford et al. in view of Creevy et al. to be an angled surface on a forward edge of the radially inward side for the purpose of reducing the leakage of shroud cooling air.

Claims 28 and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over United States Patent Application No. 2003/0185674 (Alford et al. hereinafter) as applied to claim 27 above, and further in view of United States Patent No. 5,188,506 (Creevy et al. hereinafter).

Alford et al. show rope seals but do not state that they are hybrid.

Creevy et al. show a seal 54 for use between a turbine shroud hanger 12 and a turbine shroud 16 wherein the seal is a hybrid rope made with Inconel and silica (see col. 4, lines 19-27) for the purpose of withstanding turbine engine temperatures. Since Alford et al. teach a turbine shroud and turbine shroud support with a seal therein between and Creevy et al. teach that the seal between a turbine shroud and turbine shroud support should be made from Inconel and silica for the purpose of withstanding the hot turbine engine operating temperatures, it would have been obvious at the time the invention was made to a person having ordinary skill in the art to make the Alford et al. seal from Inconel and silica, as taught by Creevy et al. for the purpose of withstanding turbine engine operating temperatures.

Claim 30 is rejected under 35 U.S.C. 103(a) as being unpatentable over United States Patent Application No. 2003/0185674 (Alford et al. hereinafter) as applied to claim 27 above, and further in view of United States Patent Application 2004/0120808.

Alford et al. show circumferentially adjacent shroud segments but do not show ceramic spacer seals therein between.

The Alford et al. 2004/0120808 patent application teaches a turbine shroud assembly comprising: a plurality of ceramic shroud segments 24 assembled circumferentially about a longitudinal engine centerline axis; and a plurality of ceramic spacer seals 44 (see paragraph 0016, lines 6-9) positioned in contact with said ceramic shroud segments, such that each one of said ceramic spacer seal is in contact with the

radially outward side of two adjacent ceramic shroud segments (see Fig. 2) for the purpose of sealing adjacent segments.

Since the 2003/0185674 patent application shows adjacent shroud segments and the 2004/0120808 patent application shows how to seal adjacent shroud segments, it would have been obvious at the time the invention was made to a person having ordinary skill in the art to seal the adjacent shroud segments of the 2003/0185674 patent application with the seals taught in the 2004/0120808 patent application for the purpose of sealing adjacent shroud segments.

Claim 31 is rejected under 35 U.S.C. 103(a) as being unpatentable over United States Patent Application No. 2003/0185674 in view of United States Patent Application No. 2004/0120808, as applied to claim 30 above, and further in view of United States Patent No. 6,197,424 (Morrison et al.).

The patent applications 2003/0185674 and 2004/0120808 show ceramic seals made from a CMC material. However, Silicon nitride (SiN) is not specifically recited in any of the references.

Morrison et al. teach that CMC materials, including silicon nitride are used in turbine engines for the purpose of withstanding the operating temperatures of the turbine (see paragraph 25).

Since the patent applications 2003/0185674 and 2004/0120808 show ceramic seals made from a CMC material and Morrison et al. teach that silicon nitride, also a CMC material, should be used in turbine components, it would have been obvious at the

time the invention was made to a person having ordinary skill in the art to use a silicon nitride material for the seals as taught by Morrison et al. for the purpose of withstanding the operating temperatures of the turbine.

Claim 32 is rejected under 35 U.S.C. 103(a) as being unpatentable over United States Patent Application No. 2003/0185674 (Alford et al. hereinafter) as applied to claim 27 above, and further in view of United States Patent No. 5,273,396 (Albrecht et al. hereinafter).

Alford et al. show a shroud segment being cooled by a plenum assembly, but do not show a balloon with an impingement array therethrough, flow metering openings and inlet openings.

Albrecht et al. show a shroud segment being cooled by a plenum balloon 94 having impingement openings 98 in communication with metering openings 92 and inlet openings 88 for the purpose of cooling the shroud.

Since Alford et al. show a shroud segment being cooled by a plenum and Albrecht et al. teach a plenum having impingement, metering and inlet openings, it would have been obvious at the time the invention was made to a person having ordinary skill in the art to use the plenum balloon configuration of Albrecht et al. as the plenum cooling teaching of Alford et al. for the purpose of directing cooling air to the shroud segments.

Contact Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Richard Edgar whose telephone number is (571) 272-4816. The examiner can normally be reached on Mon.-Thur. and alternate Fri., 7 am- 5 pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Edward Look can be reached on (571) 272-4820. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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